3-2016

Challenges and Opportunities in the Culture of Giant Freshwater Prawn in the Philippines

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Amid the irremediable decline of capture fisheries, the Philippine government has identified aquaculture as a sector that will ensure food security and generate new job opportunities geared toward the country's goal of economic development (Nagothu and Ortiz 2007). Aquaculture of giant freshwater prawn *Macrobrachium rosenbergii* (Fig. 1) is an emerging program that is intended to expand and vary the aquatic species used in freshwater aquaculture, which is still predominantly based on tilapia (Rosario and Tayamen 2004). Attractive characteristics of freshwater prawn culture include ease of breeding, high hatching rate, superior quality of meat and high market value (Keysami and Mohammadpour 2013).

Giant freshwater prawn is cultured in about 43 countries, with Asia representing more than 98 percent of global production (Mather and de Bruyn 2003). Principal producers are Bangladesh, China, India, Myanmar, Taiwan, Thailand and Vietnam (New and Nair 2012). It is widely distributed in most tropical and sub-tropical countries, including the Philippines. More than 100 species exist globally, 12 of which are found in the Philippines (Rosario and Tayamen 2004). The giant freshwater prawn is a dominant species, along with four others. It thrives in inland bodies of water in Agusan, Bicol region, Bulacan, Cagayan, Cotobato, Ilocos, Laguna, Lanao, Leyte, Maguindanao, some parts of Mindanao, Palawan, Pampanga, Pangasinan, and Samar (Rosario and Tayamen 2004).

FIGURE 1. *Adult giant freshwater prawns at the Bureau of Fisheries and Aquatic Resources-National Freshwater Fisheries Technology Center, Muñoz City, Nueva Ecija, Philippines.*

FIGURE 2. *Experimental-scale culture of giant freshwater prawn in net cages at the Bureau of Fisheries and Aquatic Resources-National Freshwater Fisheries Technology Center, Muñoz City, Nueva Ecija Philippines.*

Names for freshwater prawn in local dialects are *ulang* (Bulacan, Laguna, Zambales and most parts of the country), *udang* (Ilocos, Cagayan and other parts of Northern Luzon), *urang* (Leyte), *budsang* (Bicol), *kalig* (Leyte), *kising-kising* (Pangasinan), *padao* (Cotabato), and *paje* (Palawan and Zamboanga) (Rosario and Tayamen 2004, Tayamen 2005).

The culture of freshwater prawn in the Philippines started in the 1970s. Culture trials ensued (Fig. 2), but technology was not sustained at the commercial level. Mass-production of seed and post-larvae were established by the Bureau of Fisheries and Aquatic Resources (BFAR) in the early 2000s. Since then, BFAR and other government agencies have conducted technology dispersal programs. Freshwater prawn production in ponds increased from 2.80 t in 2010 to 2.86 t in 2011 (BFAR 2010, 2011). The same trend was seen in aquaculture systems using small-farm reservoirs, which produced 1.56 t in the same year, an increase of 0.30 t from the previous year (BFAR 2010, 2011).

The giant freshwater prawn is considered to be the world's largest shrimp. In the wild, freshwater prawn can grow to 500

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g and fetch approximately US$ 10/kg (Tayamen 2005). The freshwater prawn is gradually establishing a niche in local markets and also represents a multi-million dollar export opportunity to Japan, US, Taiwan and the European Union. Freshwater prawn is a high-value species that represents an alternative to black tiger shrimp *Penaeus monodon* and whiteleg shrimp *Litopenaeus vannamei*. Farmed freshwater prawns on average weigh from 30-100 g, which about the same size as medium to jumbo black tiger shrimp.

Infectious Diseases in Freshwater Prawn Culture

With the steady increase of global and local shrimp market prices in recent years, shrimp aquaculture has been converting from extensive and semi-intensive farming to super-intensive systems. This change in farming system can cause serious problems with infectious diseases because cultured shrimps are exposed to stressful conditions. Disease control and biosecurity are among the most critical issues that threaten the sustainability of commercial shrimp farming.

Giant freshwater prawn has been cultured for over 40 years, but there is scant information on pathogens and parasites (Arthur *et al*. 2005). Although it is a moderately disease-resistant species compared to penaeid shrimp (Ravi *et al*. 2009), with the rapid development of intensive farming, microorganisms have been implicated in many serious diseases (Liang *et al*. 2011).

The common causes of infectious diseases in giant freshwater prawn are mostly viruses and bacteria (*Vibrio* and *Aeromonas*) that impede production of seed and cause stock mortalities (Bachere 2000). Early larval stages are very susceptible to vibriosis and *Aeromonas* infections, which can cause complete mortality (Tonguthai 1997). The production and survival of healthy larvae and post-larvae has been a primary hindrance in the expansion of freshwater prawn aquaculture (Prakash and Karmagam 2013).

Use of Immunostimulants in Shrimp Aquaculture

The crustacean immune system lacks adaptive immune response mechanisms and therefore defense depends on the non-specific immune response. The non-specific immune defense of crustaceans is primarily attributed to hemocytes, which are specialized blood cells that carry out cellular and humoral mechanisms such as phagocytosis and encapsulation, and production of antimicrobial substances to combat foreign particles and infectious agents, among others (Lio-Pio and Inui 2010). Additionally, crustaceans upregulate expression of immune-related genes in response to viruses and other pathogens.

One promising technique for prophylaxis and disease control is to increase the immune status of shrimp with immunostimulants. According to Bricknell and Dalmo (2005), "An immunostimulant is a naturally occurring compound that modulates the immune system by increasing the host's resistance against diseases that in most circumstances are caused by pathogens." This approach enhances innate immune responses, resistance to bacterial and viral infections, resistance to pathological and environmental stresses, and growth performance in many shrimp species (Wang *et al*. 2013).

Immunostimulants used in aquaculture provoke beneficial effects because of enhanced cellular and humoral responses in cultured species (Ringø *et al*. 2012). Immunostimulants influence and target non-specific immune aspects such as complement levels, lysozyme levels, natural killer activity, phagocytic cell activity, and total immunoglobulin levels, among others (Shankar *et al*. 2012).

Different immunostimulants activate various aspects of the immune system and their efficacies are species-specific, pathogen-specific and largely depend on delivery method (Sakai 1999, Smith *et al*. 2003, Agrawal *et al*. 2010). Immunostimulants are administered by immersion, injection or through dietary inclusion (Rocha-Montero *et al*. 2006, Chiu *et al*. 2010, Wang *et al*. 2013). Dietary immunostimulants offer a cheap and effective method for increasing the productivity and cost-effectivness of aquaculture operations by enhancing disease resistance and stress tolerance and reducing the need for more radical and costly disease control measures.

A number of substances confer immunostimulatory properties in different species of cultured shrimp. Immunostimulants include inactivated microbes and their cellular components, complex carbohydrates and polysaccharides, animal extracts, cytokines, lectins, plant and herbal extracts, vitamins, minerals and synthetic compounds.

Outlook for the Future

Factors that constrain development of giant freshwater prawn culture in the Phillipines include inadequate information on nutritional requirements of the prawn, the need for broodstock and seed improvement, lack of technological innovations that lower production cost and improve its growth and survival, and low extension of technology to potential farmers (Rosario and Tayamen 2004, Tayamen 2005, De Guzman 2008). Freshwater prawn aquaculture continues to face serious risks and threats of diseases, which explains in part the decrease in global production of prawns (Angeles *et al*. 2009, Kutty 2005).

The risk and threat of disease outbreaks can be reduced with the use of dietary immunostimulants. This practice can support good production levels of freshwater prawn when disease resistance through dietary stimulation is achieved. Development of this industry can certainly translate to employment opportunities, providing prawn farmers with stable jobs and livelihoods.

Notes

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